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[COMMUNICATION]

Life History of the Jumping Spider *Silerella vittata* (Karsch) (Araneae, Salticidae)

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ABSTRACT—Adult females of *Silerella vittata* (Karsch) collected on 26 June 1988 survived for 119–462 days under semi-outdoor conditions, with a mean±S.D. of 275.2±91.9(9) days. During this survival period over 2 calender years, they oviposited twice or occasionally 3 times. The mean total number of offspring produced per female was 20.0±5.8(9). Nymphs, which had just emerged, were reared on ants only, ants and flies, or flies only; they all developed normally irrespective of the difference in food conditions. The mean developmetal period to adulthood was 329.7±12.7(6) days when reared on ants only, 323.3±9.9(10) days on ants and flies, and 307.6±2.9(5) days on flies only. It was considered that one generation of the spider extends over 2–3 calender years. Generation overlap occurs due to bioviparity in a season and uncertainty of overwintering stage(s). The relationship between the spider and ants was discussed.

INTRODUCTION

The jumping spider *Silerella vittata* (Karsch) usually lives in grasslands, where several ant species build their nests, and is known to attack these ants [1, 2]. In addition, adults and nymphs at different instars can easily be found from spring to autumn in the field. It is suggested, threfore, that this spider must have a close connection with the ants and a mode of life bearing overlapping generations during the year.

In order to clarify these points, life history of the species was investigated by means of rearing under semi-outdoor conditions.

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MATERIALS AND METHODS

Ten adult females were collected at Komazawa Park adjoining the Tokyo Metropolitan University on 26 June 1988, and kept individually in glass vials, 4 cm in diameter and 7.5 cm in height. Each vial was packed with wet soil about 1 cm deep to provide humidity for the spiders, and plugged with cotton. A small amount of water was supplied when the soil became dry. The vials were placed in a semi-outdoor situation protected from direct sunshine, rain and wind, so that temperature was not controlled.

The experimetal animals were each provided 4–6 prey at intervals of 3–4 days until their death, except for their overwintering period from 1 November to 1 March of the following year. The prey provided consisted of 2 groups, ants and flies. The former were larvae and/or pupae of *Pristomyrmex pungens* and *Tetramorium caestitum* (Myrmicinae). The latter were adults of *Drosophila melanogaster* (Drosophilidae), *Sepsis monostigma* (Sepsidae) and *Elachiptera sibirica* (Chloropidae). Each group of prey was used alternately.

The dates of oviposition and egg hatching were recorded. When newborn nymphs emerged from the mother's nest web, they were counted and then removed with a brush.

In order to reveal the relationship between the nymphal development of this spider and ants as prey, 20 nymphs just emerged from their mother's nest on 7 August (2nd instar nymphs because 1st molt occurs in the mother's nest without feeding) were divided into 2 groups of 10, and reared under

2 different food conditions. One group was provided ants only (Group A) and the other ants and flies alternately (Group B). In addition, 6 nymphs emerging on 14 September were reared on flies only (Group C). Rearing methods were the same as for the adult females. However, small-size prey were provided for the first half of the rearing, and the number of prey provided was increased from 2–4 to 4–6 as development of the nymphs proceeded. Prey were not provided from 1 November to 1 March of the following year.

RESULTS AND DISCUSSION

Figure 1 shows the survival period and oviposition sequence of 9 adult females reared under semi-outdoor conditions. One female was omitted from this graph because of death before oviposition.

All the females produced their first egg batch 7–21 days after the commencement of rearing. Four of the 9 females produced a 2nd egg batch about one month later, and one female produced a 3rd egg batch in the summer of the following year. Since the age of experimental animals at collection was unknown, it is very difficult to assess the real longevity and the potential number of ovipositions during their life based on these results. It is certain, however, that the majority of females live over 2 calender years and oviposit 1–2 times during their life. Although the number of eggs in each oviposition showed a sharp decrease from 1st to 2nd and/or 3rd (Table 1), the total number of eggs produced by each female ranged from 11 to

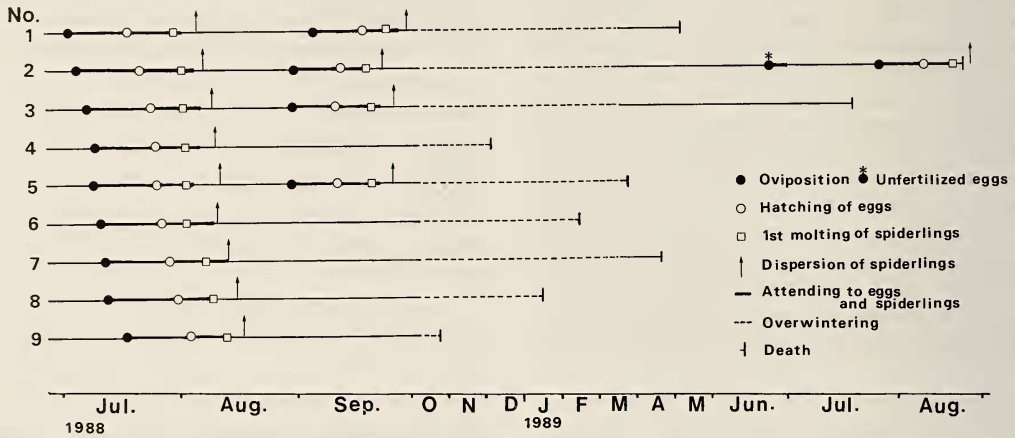

FIG. 1. Survival period and oviposition sequence of 9 adult females reared under semi-outdoor conditons.

TABLE 1. Mean duration of egg stage, 1st nymphal stage, parental care, period from oviposition to nymph dispersal, and mean number of nymphs emerging after each oviposition of *Silerella vittata* reared under semi-outdoor conditions

Oviposition	1st (n=9)		2nd (n=4)		3rd (n=1)
	Mean±S.D.	Range	Mean±S.D.	Range	
Egg period (days)	16.9±0.9	16–19	12.3±0.8	11–13	12
1st nymphal instar period (days)	8.6±1.2	7–11	8.3±1.3	7–10	9
Period of parental care (days)	28.3±1.6	26–30	22.0±1.8	19–24	19
Period from ovipos. to nymph dispersal (days)	32.7±1.0	31–34	25.5±1.6	23–27	24
No. of nymphs per oviposition	16.8±5.2	6–25	6.8±0.8	6–8	6

31, the calculated mean being 20.0±5.8.

The female spins a small and thin domed nest web and oviposits in it. She attends her eggs and offspring until they develop to the 2nd instar. After the mother has left the nest, the 2nd instar nymphs also begin to disperse from the nest. Males and nymphs also spin thin nests and rest or overwinter in them.

The duration of the egg stage, 1st nymphal instar and parental care by mother are shown in Table 1. In the 1st oviposition, the mean durations of the egg stage and 1st nymphal instar were 16.9±0.9 and 8.6±1.2 days, respectively. Parental care continued longer than the sum total of the egg stage and 1st nymphal instar, with the mean becoming 28.3±1.6 days. During this period, the mother spiders cleaned the eggs and threw away eggshells and exuviae from the nest, but parental feeding upon offspring was not observed. In the 2nd oviposition, the values were less, because development of eggs and 1st instar nymphs was accelerated by the high summer temperature.

The survival period of adult females showed a great variation, ranging from 119 to 462 days. The calculated mean duration was 275.2±91.9 days. During overwintering from November to the end of Feburary of the following year, the females generally stayed in their nests. However, the results shown in Figure 1 suggest that they suffer a relatively high mortality during winter.

Five adult males collected in autumn were also reared under the same conditions as for females, 2 individuals overwintered successfully. This guggests that some adult males are able to overwinter.

Figure 2 shows the developmental processes of nymphs reared under 3 different food conditions. During the rearing of Groups A and C, 4 and 1 individuals died, respectively, and are omitted from the graph. During the rearing of Group A, 6 of the 10 individuals developed to adults successfully. All individuals developed to adults during the rearing of Group B. In the rearing of Group C, 5 of the 6 individuals did so in spite of the commencement of rearing being about a month

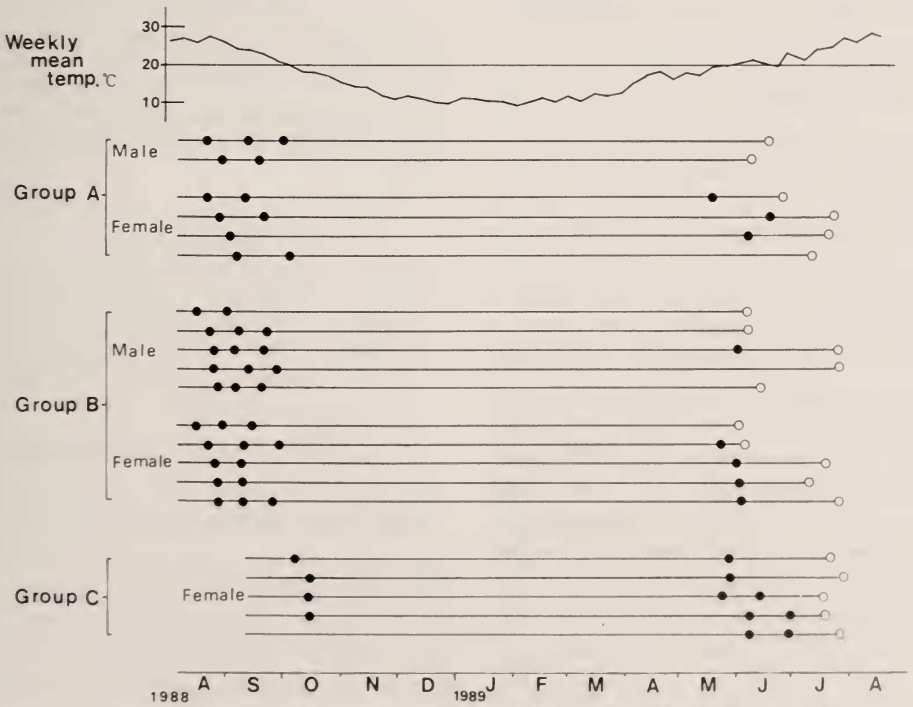

FIG. 2. Developmental process of nymphs reared under 3 different food conditions. Group A was provided ants only, Group B ants and flies alternately, and Group C flies only. Black and white circles indicate ordinal and final moltings, respectively. The upper graph shows the weekly mean temperature.

late in comparison with the others. The cause of the high mortality during rearing on ants only (Group A) is unknown.

An interesting behavioral feature of this spider is that of ant robbing. The spider loiters beside a column of marching ants, chooses an ant worker carrying an object to seize and, when the ant passes by, suddenly steals the object. According to field observations, most the frequently observed stolen objects are larvae and pupae carried by marching workers of *Pristomyrmex pungens*. They sometimes attacked wandering solitary workers of *Tetramorium caespitum, Pheidole fervidae* and *Lasius nigar*. The results shown in Figure 2 clearly indicate, however, that the spider can develop normally without ants. In addition, ants do not always march throughout the active season of the spider. It is considered, therefore, that the spider does not depend completely upon ants. Such a situation is probably because the hunting of ant larvae tends to be hit or miss, although they have developed a skilled hunting behavior for stealing from marching workers. Their behavior is presumably therefor also successful for hunting prey other than ants.

As shown in Figure 2, nymphal development extended over 2 calender years irrespective of the difference in food conditions. The mean length of period for development to adulthood was 329.7 ± 12.7 days in Group A, 323.3 ± 9.9 days in Group B, and 307.6 ± 2.9 days Group C, when calculation is adjusted for the mix of both sexes. There was no significant difference among these figures ($P > 0.1$ by t-test). In short, the nymphal development of this spider was scarcely influenced by the difference in food conditions. Overwintering occurred at various instars other than the first one. When nymphal development began late in the season, overwintering occurred at early instars (see Group C in Fig. 2). These facts and the occurrence of a 2nd oviposition in the same female within a season together indicate that it is natural for adults and nymphs at various instars to occur from spring to autumn in the field. In other words, generation overlap commonly occurs in this spider due to bioviparity in a season and uncertainty of overwintering stage(s). Matsumoto and Chikuni reported an interesting case of generation overlap in the jumping spider *Sitticus fasciger* (Simon); in this case there was a local population consisting of 2 groups in which the generation cycles differed from each other [3].

The number of molts required for development to adulthood varied from 4 to 6, including the molt in the mother's nest. This value is somewhat less than that for 4 species of jumping spider mentioned by Hallas, who reviewed instars of maturity in differnt spider species recorded in the literature [4]. Another Japanese jumping spider, *Plexippus setipes* (Karsch), reared under a constant temperature and photoperiod showed 1–2 molts more than *S. vittata* [5].

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